Thought Question

After testing a number of prosopagnosics, a researcher finds that, although they recognize most types of objects with no trouble, in addition to their face processing problem they seem to have difficulty recognizing houses. What might you hypothesize from this finding about how houses are processed and about what behavioral effects you should observe for house recognition in normal participants?

Views of Categories

- **Classical view**
    - category is an all-or-none definition
    - static and unitary
- **Probabilistic Views**
    - *Prototype View*
        - category is an abstract list of features
        - probabilistic, but still static and unitary
    - *Exemplar View*
        - category is a set of exemplars
        - not unitary and not static (because can choose which exemplars to compare with)
- **Knowledge-based View**
    - says that similarity is not enough to explain full range of categorization behavior

Knowledge Organization

Semantic Memory

- Long term store of general information
  - words and their meanings (“mental lexicon”)
  - facts and general knowledge

Recognizing Words

- What is special about words?
  - Reading is a critical, modern skill.
  - Words are *strings* (sequences of letters).
  - Order crucially determines the identity of the word: PAT, TAP, TAPE, APE

Disorders of word processing

Alexia

- Specific inability to read written words.
- Patients are okay with other types of visual material.
- Not a language disorder: can write, can understand and produce spoken speech normally.
- Patients know when they are looking at a word, but cannot read it.
- Often can pick out individual letters -- sometimes, if allowed to say the letters aloud (spell out the word), they can identify it.

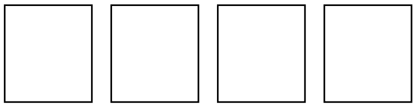
What disorders reveal:

Word processing . . .

- can be *dissociated* from the processing of other visual objects.
  - (like faces, words are also “special” objects)
- happens at multiple processing levels.
  - letters
  - whole words

➢ is not a simple function of letter processing.

Word superiority effect



Word superiority effect

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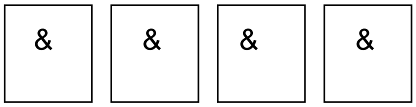
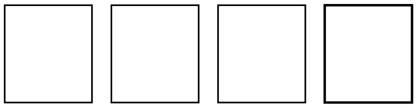
Word superiority effect

Z F R T

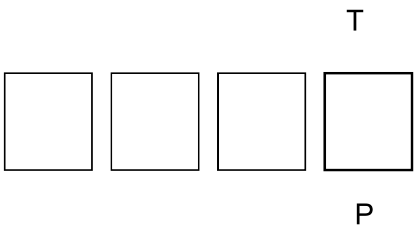
Word superiority effect



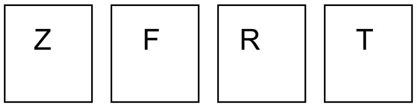
Word superiority effect



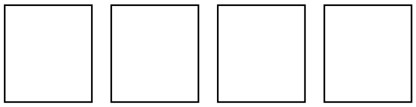
Word superiority effect



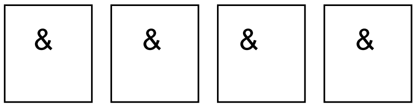
Word superiority effect



Word superiority effect



Word superiority effect



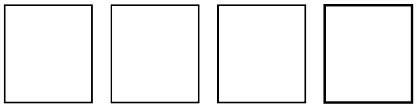
Word superiority effect

W	O	R	K

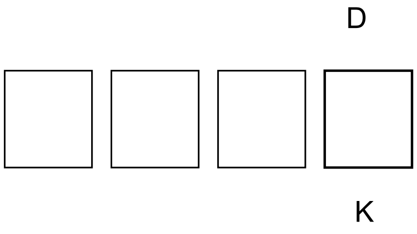
Word superiority effect

&	&	&	&

Word superiority effect



Word superiority effect



Word superiority effect

W O R K

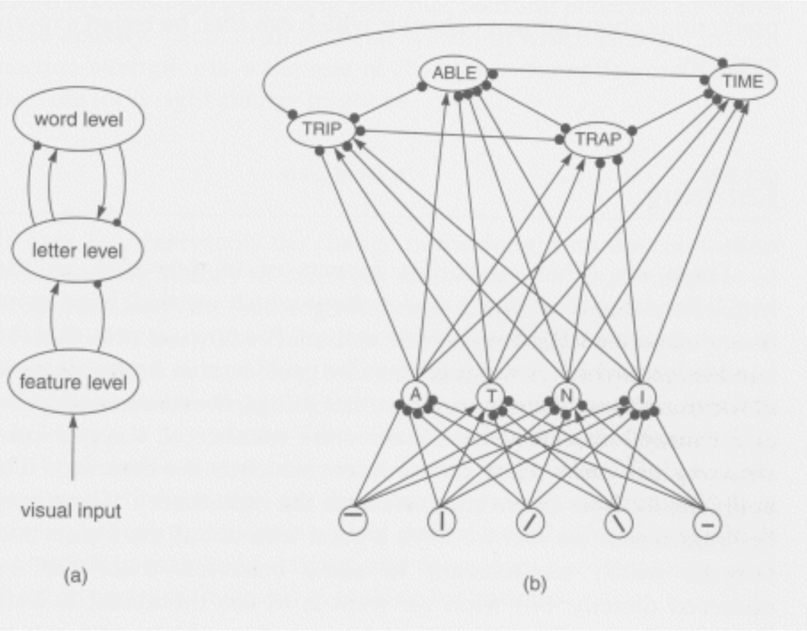
Word superiority effect

- People are much faster and more accurate to identify a letter if it appears in a real word.
- This is true even when both choice letters could form a word. Why is this important?

Another example

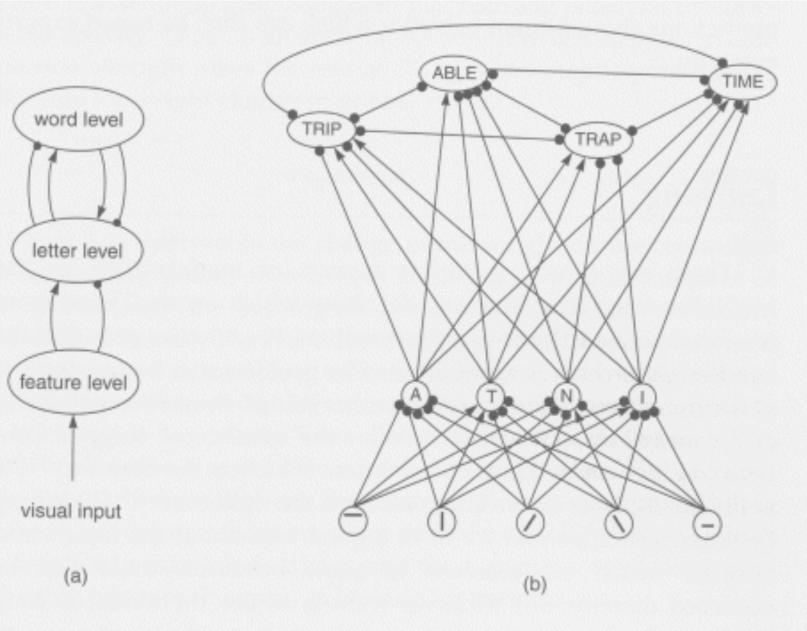
- Aoccdrnig to a rscheearch at an Elingsh uinervtisy, it deosn't mttaer in waht oredr the ltteers in a wrod are, the olny iprmoetnt tihng is taht the frist and lsat ltteer be at the rghit pclae. The rset can be a toatl mses and you can sitll raed it wouthit porbelm. Tihs is bcuseae we do not raed ervey lteter by istlef but the wrod as a wlohe.

McClelland and Rumelhart (1981)



McClelland and Rumelhart (1981)

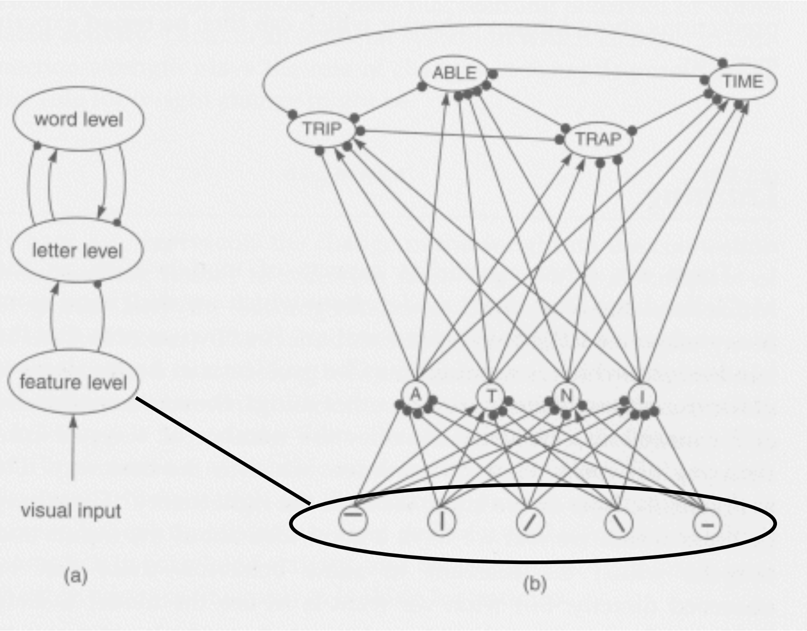
A node's activation reflects the extent to which the system believes that a particular item is present.



McClelland and Rumelhart (1981)

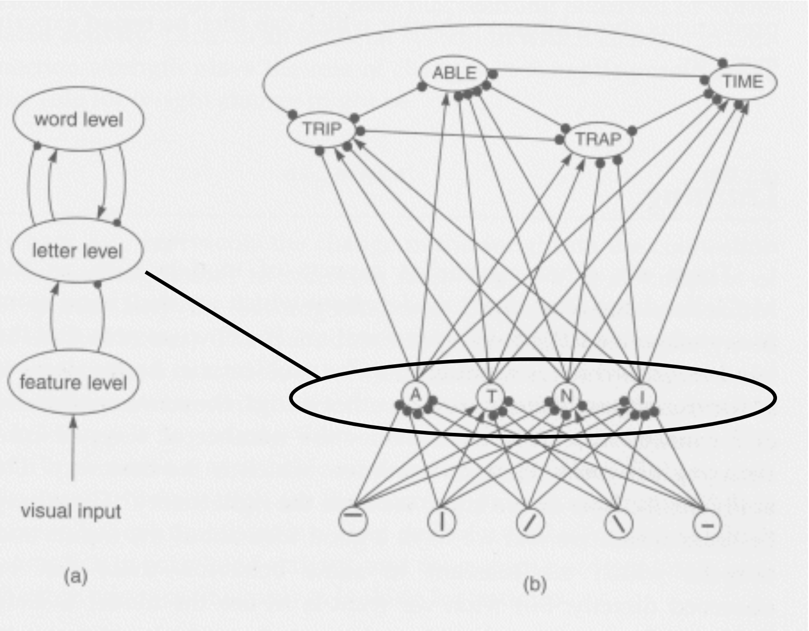
Processing begins with activation of the feature nodes.

These are the features of one letter position in the network (the first letter, for example).



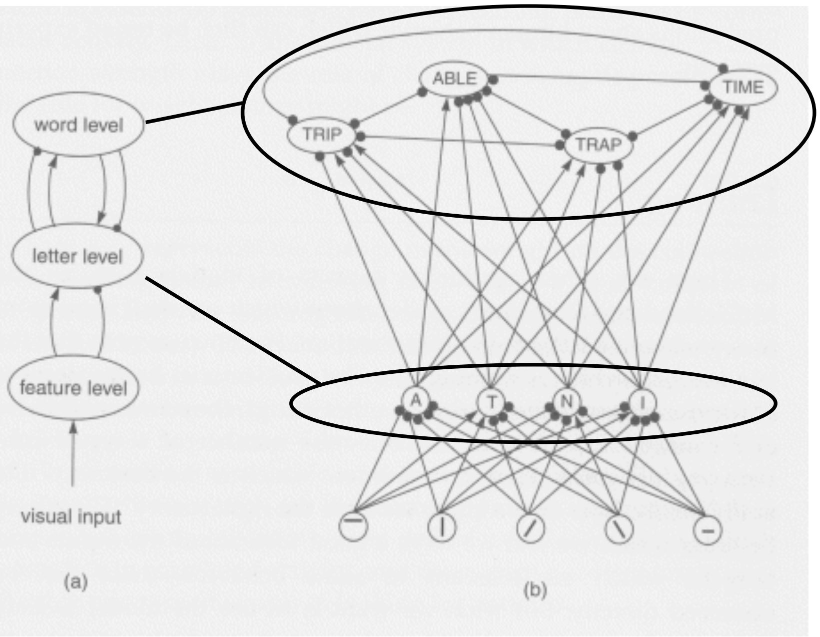
McClelland and Rumelhart (1981)

Activation then flows through the system to letter nodes.



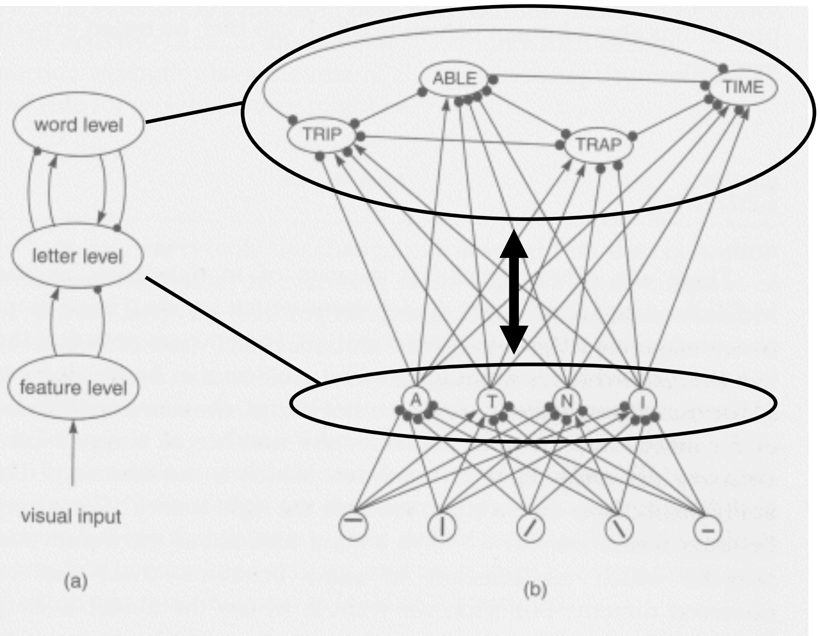
McClelland and Rumelhart (1981)

As the letter nodes begin to become active, they activate their corresponding word nodes.



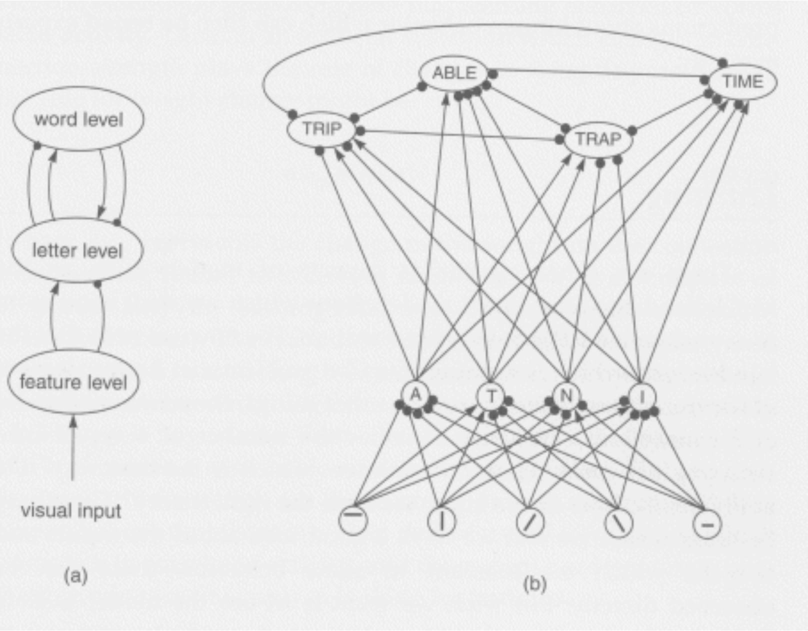
McClelland and Rumelhart (1981)

The words ALSO activate the letter nodes, at the same time as the letter nodes activate the words.



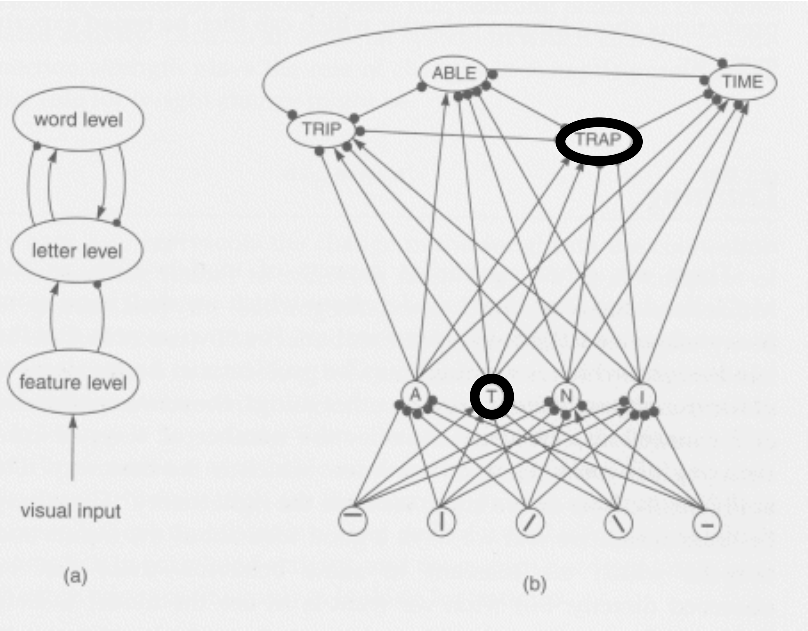
McClelland and Rumelhart (1981)

Nodes within the same level compete to become most active.

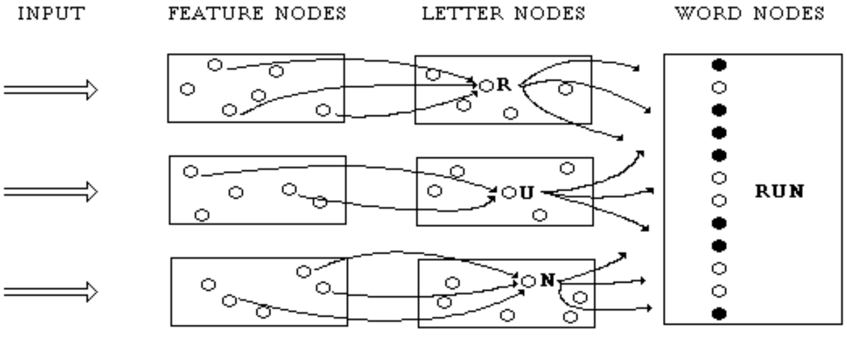


McClelland and Rumelhart (1981)

In the end, one word and one set of letters (one for each position) become most active.

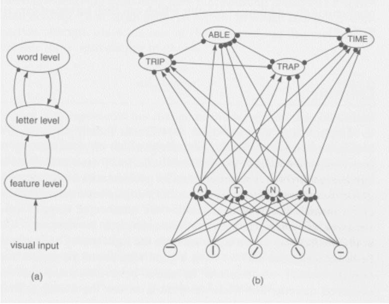


McClelland and Rumelhart (1981)



Note that there is a separate set of feature and letter nodes for each position in the word, each connected to the same set of word nodes.

Word superiority effect

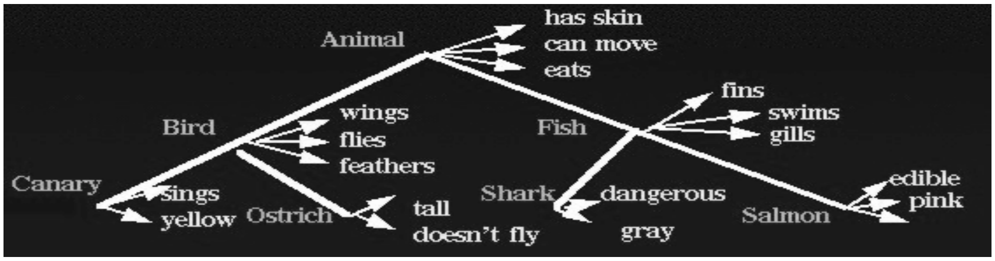


- This model naturally creates a word superiority effect.
- WHY?
- Identifying letters in words is easier because of the interactive, top-down support from the word level.

How is knowledge about words organized?

- Many models assume that knowledge is represented **symbolically.**
  - Examples: words, numbers, variables
- Representations that include relationships between symbols are called propositions.
- Two examples:
  - semantic network model
  - spreading activation model

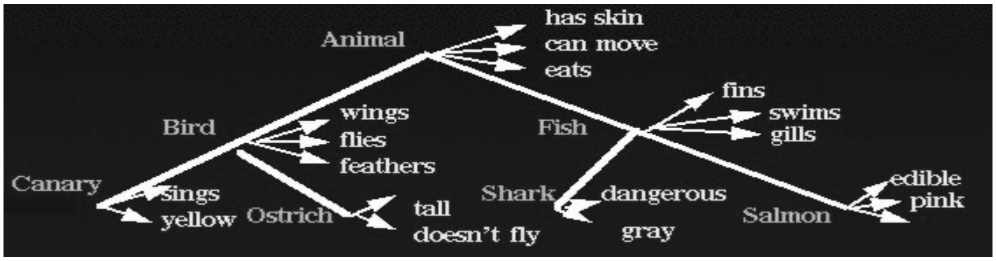
Semantic Network Models



- Concepts represented as hierarchies of interconnected concept nodes.
- Nodes have associated features.

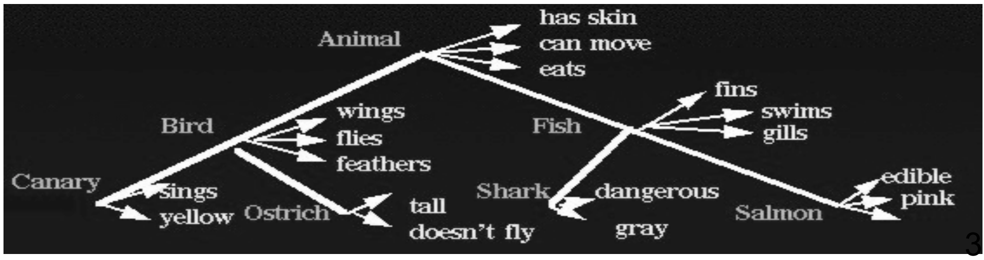
Representational Assumptions

- Propositional representations
- Hierarchical: superordinates & subordinates
- Cognitive economy
  - Properties stored at most general (highest) possible level
  - Subordinates inherit attributes of superordinates

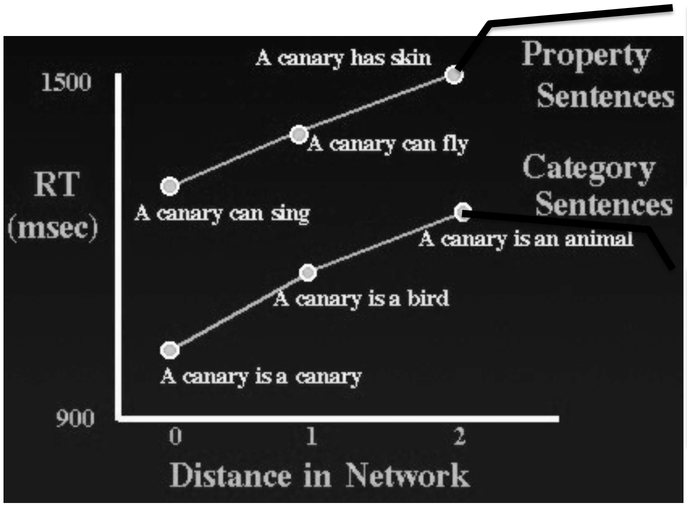


Predictions

- Category size effect
  - Compare
    - A canary is a bird.
    - A canary is an animal.
- Cognitive economy
  - Compare
    - A bird has feathers.
    - A bird has skin.

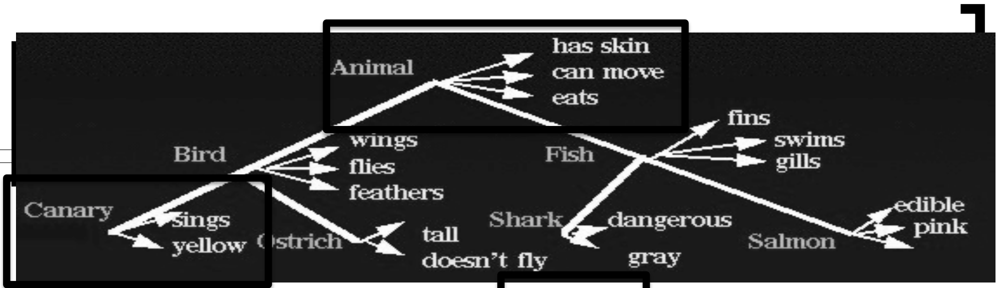


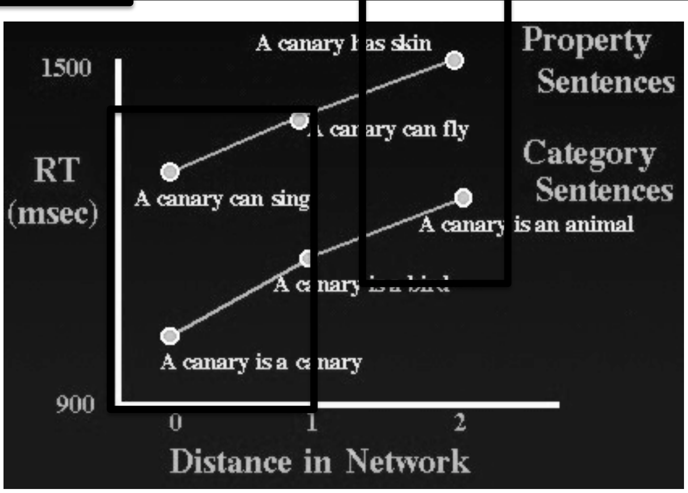
Data consistent with predictions



true of all animals; further away in network = slower

category further away in network = slower





Inconsistent data

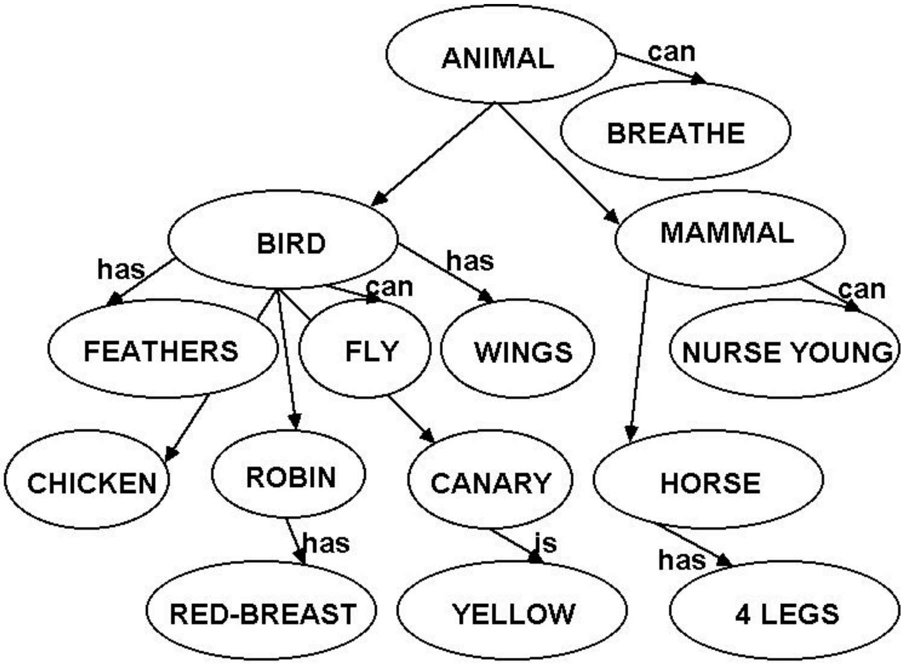
- Challenges to hierarchical assumption
  - Reversal of category size effects
    - “A dog is a mammal” *vs.* “A dog is an animal.”
  - Typicality effects
    - “A canary is a bird” *vs.* “An ostrich is a bird.”
- Challenge to cognitive economy
  - Reaction time more strongly related to associative strength than proposed distance in hierarchy

Importance of Association

Example	Distance	RT	Example	Association	RT
Banjo-strings	0	1100	Orange-edible	Strong	1060
Goose-wings	1	1150	Elm-roots	Medium	1110
Orange-edible	2	1060	Goldfish-mouth	Weak	1210

Spreading Activation (Collins & Loftus, 1975)

- Structure: Not hierarchical
  - Distance proportional to relatedness
  - Search time depends on distance
- Mechanism: Spreading activation
  - Activation of one node leads to activation of other nodes nearby
- Activation decreases with time



New Predictions

- Typicality Effects (robins vs. chickens)
- BONUS: Semantic Priming Effects (related vs. unrelated)

Type of trial	Prime	Target	RT
Related prime	bread	butter	600
Unrelated prime	nurse	butter	670

Conclusions

- Knowledge can be represented as a system of interconnected symbols.
- Different kinds of relationships are represented as different kinds of links (“is a”, “has”).
- Depending on the model, can vary factors like position on the tree, and/or distance and strength of the connection to fit human behavior.

Importance of representation type

- There are different ways of representing the same information.
- Different representations require different processes to extract that information.
- We will find different things easy and make different types of errors depending upon the representation we have.

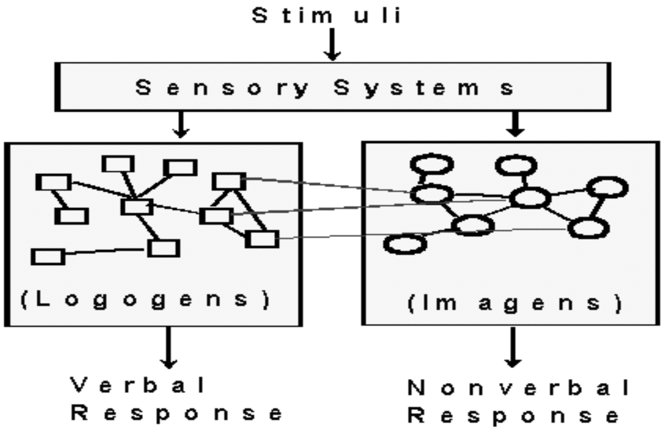
Representation in Cognitive Psychology

- Two types of representation have dominated models in cognitive psychology:
  - symbolic/propositional
  - imagistic/analog

Symbolic	Imagistic
Examples: words, numbers, variables	Examples: photographs, maps, caricatures
Abstract	Concrete
Relation by convention	Iconic
Discrete	Distributed
No spatial medium	Spatial medium
No point-for-point correspondence	Point-for-point correspondence
Unambiguous	Ambiguous

Dual-coding theory (Paivio)

* Two independent, interconnected systems
  - Nonverbal (imagery)
  - Verbal (propositional)



Try to remember the following words

- Bed
- Apple
- Book
- Chicken
- Airplane
- Telephone
- Football
- Computer
- Lamp
- Lipstick
- Briefcase
- Chair
- Horse
- Jacket

Try to remember the following words

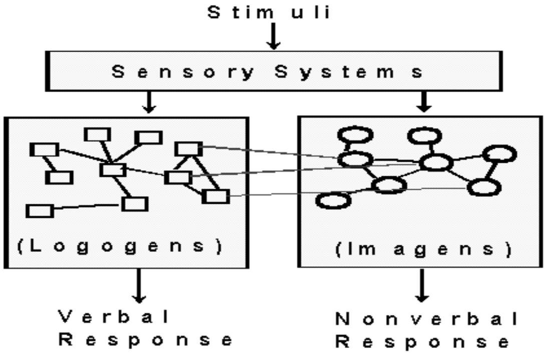
- Hour
- Topic
- More
- Truth
- Random
- Set
- Help
- Location
- Enemy
- Belief
- Same
- Curt
- Fashion
- Member

Which list was easier?

- What was the critical difference between the lists?
- Why might that matter?

Dual-coding theory (Paivio)

- How might each of these be encoded?
- What are the implications for memory?
  - "belief"
  - "cat"
  -



Implications

- Dual-coding theory suggested that people use multiple types of mental representations.
- But cognitive psychologists remained skeptical about existence of mental images.
- How can that be?
- Other explanations: concrete things more familiar, more sensory associations (but represented symbolically), etc.

Analog representations

- To understand whether or not some mental representations are image-like, need to
  - focus on how propositional and analog representations are different
  - determine what *different* behaviors each view would predict

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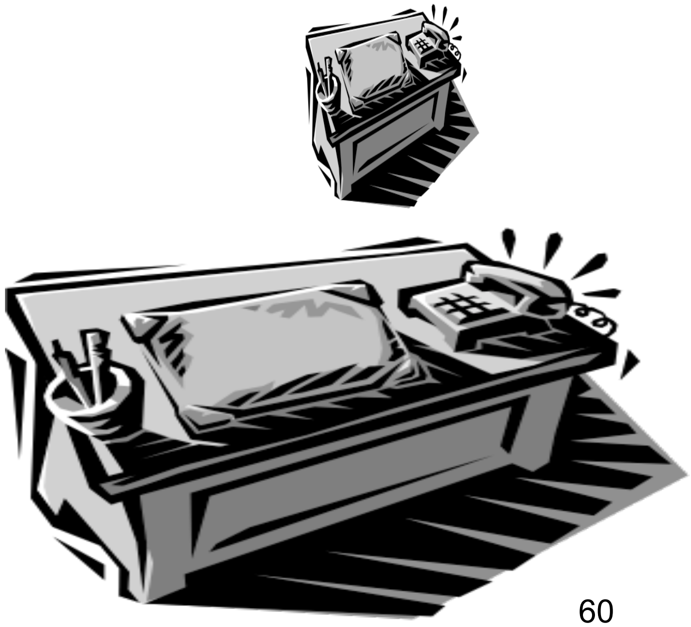
Symbolic Imagistic

Symbolic	Imagistic
Examples: words, numbers, variables	Examples: photographs, maps, caricatures
Abstract	Concrete
Relation by convention	Iconic
Discrete	Distributed
No spatial medium	Spatial medium
No point-for-point correspondence	Point-for-point correspondence
Unambiguous	Ambiguous

Properties of mental images

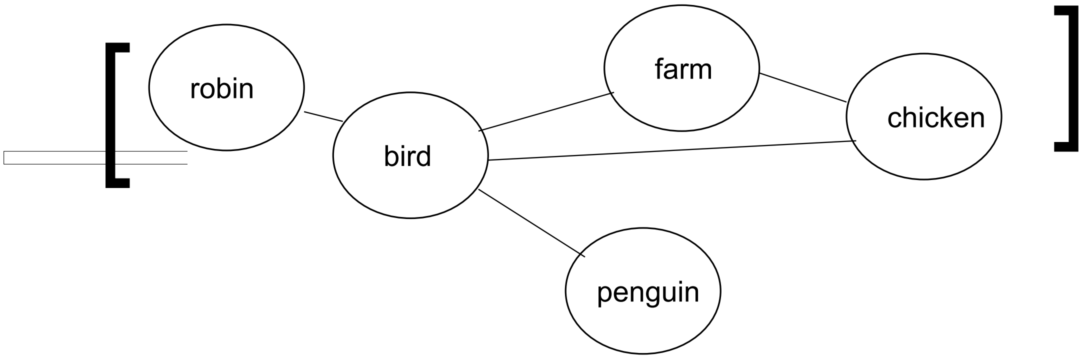
- *Spatial equivalence:* spatial arrangement of objects in mental images corresponds to actual arrangement in real world.
- *Transformational equivalence:* operations performed on images have the same dynamic characteristics as in real world.

Propositional Analog



"The phone is on the
right side of the small desk."

"The phone is on the
right side of the big desk."



Consider this spreading activation model of knowledge organization. Which of the following will the model be able to explain?

I. Typicality effects: People are faster to respond “yes” to “A robin is a bird” than “A penguin is a bird”

II. Context effects: People respond more quickly to “robin” than “chicken” after reading “bird” BUT they respond more quickly to “chicken” than “robin” after reading “farm bird”

III. Semantic priming effects: People respond more quickly to “penguin”after having seen “robin” than after having seen “table”